Appendix C — Floodplain/Wetlands Assessment

Floodplains and wetlands on the Hanford Site (including portions of the Columbia River, Yakima River, and Cold Creek floodplains; associated wetlands; and other wetlands and deep water habitats on the Hanford Site) could be affected under each of the land-use alternatives that are identified in this Final HCP EIS. The magnitude of these effects depends, in part, on the land-use designations associated with the floodplains and wetlands under each alternative. Floodplains and wetlands are protected from any adverse Federal actions by several laws, regulations, and orders. This Floodplain/Wetlands Assessment identifies the floodplains and wetlands potentially affected by future land-use designations under each alternative. This appendix also provides a brief discussion of floodplain and wetland natural functions and values, as well as the steps to minimize impacts on floodplains and wetlands. The alternatives identified in this assessment are described in detail in Chapter 3.

C.1 Introduction

Under Executive Order 11988, *Floodplain Management*, and Executive Order 11990, *Protection of Wetlands*, Federal agencies are required to consider the impact of proposed actions on wetlands and floodplains. The U.S. Department of Energy (DOE) requirements for compliance with Executive Orders 11988 and 11990 are found in Title 10, *Code of Federal Regulations* (CFR), Part 1022, "Compliance with Floodplain/Wetlands Environmental Review Requirements." A floodplain/wetlands assessment consists of a description of the proposed action, a discussion of its effects on the floodplain and wetlands, and consideration of the alternatives. The Executive Orders are intended to be used by Federal agencies to implement floodplain and wetland requirements through existing procedures, such as those established to implement the *National Environmental Policy Act of 1969* (NEPA).

If DOE determines that there is no alternative to implementing a proposed project in a floodplain or wetland, a brief statement of findings must be prepared. This statement of findings would include a description of the proposed action, an explanation indicating why the project must be located in a floodplain or wetland, a list of alternatives considered, measures that will be taken to comply with state and local floodplain protection standards, and a description of the steps to be taken to minimize adverse impacts to the floodplain or wetland.

C.1.1 Floodplains Potentially Affected

A floodplain is defined as ". . . lowlands adjoining inland and coastal waters and relatively flat areas and flood-prone areas of offshore islands including, at a minimum, that area inundated by a 1 percent or greater chance flood in any given year. The base floodplain is defined as the 100-year (1.0 percent) floodplain. The critical floodplain is defined as the 500-year (0.2 percent) floodplain. . ." (10 CFR 1022).

When maintained in a natural state, floodplains provide valuable services by moderating the extent of flooding, thereby (1) reducing the risk of downstream flood loss; (2) minimizing the impacts of floods on human safety, health, and welfare; and (3) providing support to wetlands, fish, and wildlife.

For the purposes of this assessment, the extent of the 100-year floodplains for the Columbia River, Yakima River, and Cold Creek was derived from a number of sources (Neitzel et al. 1997; USACE 1970; Skaggs and Walters 1981; and DOE 1987). The water flow of both the Yakima and Columbia Rivers is regulated by dams located upstream of the Hanford Site. This flow regulation serves to significantly dampen the 100-year floods. For example, on the Hanford Site, the dam-regulated, 100-year flood for the Columbia River only extends beyond the

existing riverbed in certain isolated and shallow zones. A 100-year flood would inundate marshy areas located upstream of the 100-B Reactor and a portion of the low-lying horn of land located downstream of the 100-D Reactor, but is not expected to completely inundate the islands in the Columbia River. Of the 1,142 ha (2,821 ac) of land area associated with these islands, 744 ha (1,838 ac) would be inundated by a 100-year flood.

Although the 100-year floodplain of the ephemeral Cold Creek has not been mapped, it is possible to draw preliminary conclusions from a 1981 Flood Risk Analysis (Skaggs and Walters 1981) to determine the historical extent of the watershed. In this analysis, at least two distinct segments were described: (1) an upper reach extending from the headwaters to just south of the 200 West Area, and (2) a lower reach extending from near the confluence with Dry Creek, which is located on the Fitzner/Eberhardt Arid Lands Ecology Reserve (ALE Reserve), to Horn Rapids on the Yakima River. As the upper reach of Cold Creek enters the Hanford Site, gradients diminish significantly. As a result, the channel becomes braided and interconnected. The floodplain essentially follows State Highway 240 through the Hanford Site. Conservative values for precipitation events and magnitudes of infiltration, surface roughness, and topographic parameters were used for the preliminary estimates of probable maximum flooding conditions for the Cold Creek watershed. Based on the estimate and location of the probable maximum flood, it is possible to estimate the potential impact of Hanford Site remedial actions on the much smaller 100-year floodplain of Cold Creek. The 100-year floodplain of Cold Creek probably would not include land within the boundary of the Central Plateau geographic area.

C.1.2 Wetlands Potentially Affected

The *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (EPA et al. 1989) defines wetlands by the presence of hydric soils, hydrophytic vegetation, and wetlands hydrology. Hydric soils are soils with the seasonal high-water table within 2.5 cm (1 in.) of the surface of the ground for at least 1 week of the growing season. As a result, hydric soils typically experience an oxygen depletion. Hydrophytic vegetation may grow in soils at least periodically depleted of oxygen as a result of water saturation. Hydrophytic vegetation might be able to grow only in wetlands (obligate wetlands vegetation) or may be found in upland environments as well (facultative wetlands vegetation). Wetlands hydrology requires permanent or temporary inundation of soils for at least one week during the growing season and the resultant depletion of oxygen. All three conditions must be met for a site to be defined as a wetland.

Wetlands serve a variety of functions within the ecosystem. Consideration of these wetland functions is essential in the evaluation of potential impacts. Wetland functions and values include the following:

- **Water quality preservation** -- Wetlands help maintain and improve the water quality of rivers, lakes, and estuaries. Because wetlands are located between uplands and water resources, many wetlands can intercept runoff from the land before it reaches open water. As runoff and surface water pass through, wetlands remove or transform pollutants through physical, chemical, and biological processes.

- **Flood protection** -- Wetlands help protect adjacent and downstream properties from potential flood damage by receiving and temporarily storing water during periods of high runoff or high flows in adjacent streams. Wetlands within and upstream of urban areas are particularly valuable for flood protection because the impervious surface in urban areas greatly increases the rate and volume of runoff, thereby increasing the risk of flood damage.

- **Erosion control** -- By virtue of their place in the landscape, riparian wetlands, salt

marshes, and marshes located at the margin of lakes and rivers protect shorelines and streambanks against erosion. Wetland plants hold the soil in place with their roots, absorb wave energy, and reduce the velocity of stream or river currents.

- **Biological productivity** -- Wetlands are among the most productive ecosystems in the world. The unstable nature of many wetlands produces a great diversity of niches that, in turn, support a great diversity of plant and animal species. Numerous species of microbes, plants, insects, amphibians, reptiles, birds, fish, and other wildlife depend in some way on wetlands for at least part of their life cycles. Wetlands with seasonal hydrologic pulsing are the most productive. Wetland plants play an integral role in the ecology of the watershed by providing breeding and nursery sites, resting areas for migratory species, and refuge from predators.

- **Fish and wildlife habitat** -- Diverse species of plants, insects, amphibians, reptiles, birds, fish, and mammals depend on wetlands for food, habitat, or temporary shelter. Many bird species use wetlands as a source of food, water, nesting material, or shelter. Migratory waterbirds rely on wetlands for staging areas, resting, feeding, breeding, or nesting grounds.

- **Cultural value** -- Wetlands have archaeological, historical, and cultural values. Societies traditionally have formed along bodies of water, and artifacts found in wetlands provide information about these societies.

- **Aesthetic value** -- Historically, painters and writers have used wetlands as their subject matter. Today, such artists are often joined by others with cameras, camcorders, and binoculars.

- **Economic value** -- More than half of all adults in the United States hunt, fish, birdwatch, or photograph wildlife, spending a total of $59.5 billion annually (OTA 1993). Waterfowl hunters alone spend more than $600 million annually to harvest wetland-dependent birds (OTA 1993).

- **Scientific value** -- Scientists value the processes of wetlands individually, particularly the role of wetlands in the global cycles of carbon, nitrogen, and water. Many scientists consider the removal of carbon dioxide from the atmosphere the most valuable function of wetlands (OTA 1993). Carbon sequestration is thought to be an important process in reducing the greenhouse effect and the threat of global warming.

Wetlands regulated under the *Clean Water Act of 1977* generally include swamps, marshes, bogs, and similar areas. The Hanford Site has a number of cribs, trenches, and cooling water ponds, a few of which support diverse wetland communities. Because these features serve waste water treatment or cooling water functions, they are not regulated as wetlands under the *Clean Water Act of 1977* and are not addressed in the scope of this assessment.

Wetlands on the Hanford Site have been identified from several sources, including the *National Wetlands Inventory* maps (USFWS 1976), *Priority Habitats & Species and Natural Heritage Data (Maps)* (WDFW 1993), and *Habitat Types on the Hanford Site: Wildlife and Plant Species of Concern* (PNL 1993c). Wetlands on the Hanford Site have not been formally delineated, but most Hanford Site wetlands are found in poorly developed riparian zones along the Columbia River and in association with irrigation runoff in the Wahluke Slope geographic area. Because of strong currents, rocky substrate, and often widely fluctuating water levels, the Columbia River supports a poorly developed riparian vegetation community. Other wetlands

present on the Hanford Site include several springs and ephemeral seeps on the ALE Reserve geographic area.

Columbia yellowcress, which is a State of Washington endangered species, occurs in wetlands along the Hanford Reach of the Columbia River. Pacific Northwest National Laboratory biologists recently found 18 separate groups of Columbia yellowcress along the shoreline of the 300 Area (WHC 1993). This species is usually found near the water line and is often submerged during periods of high water.

C.2 Potential Impacts on Floodplains and Wetlands

The following discussion of the proposed action evaluates potential impacts to wetlands and floodplains on the Hanford Site that could be associated with land-use designations under each alternative. The discussion is organized by geographic areas as defined for the Hanford Site in the *Final Report of the Hanford Future Site Uses Working Group* (FSUWG 1992) (except that the Columbia River and Reactors on the River geographic areas defined in the final report have been combined as the Columbia River Corridor geographic area), and is followed by a summary of impacts for each alternative. This organization takes advantage of similarities in land-use designations across alternatives for some geographic areas.

The Columbia River and Yakima River floodplains occur on the Hanford Site (Figure C-1). The floodplain associated with the Columbia River occurs along the entire length of the Hanford Reach and includes many of the islands in the river. A small portion of the Yakima River floodplain intersects the southern edge of the Hanford Site where State Highway 240 crosses onto the Site. A probable maximum floodplain associated with Cold Creek and a tributary, Dry Creek, has also been identified (Figure C-2). These creeks are ephemeral streams within the Yakima River drainage system that drain areas to the west of the Hanford Site and cross the southern portion of the Hanford Site toward the Yakima River. Surface flow, when it occurs in Cold Creek and Dry Creek, infiltrates rapidly and disappears into the surface sediments in the western portion of the Hanford Site. The natural and beneficial functions of the floodplains could be adversely affected by activities that might occur within the floodplains of Cold Creek, the Columbia River, or the Yakima River under certain land-use designations.

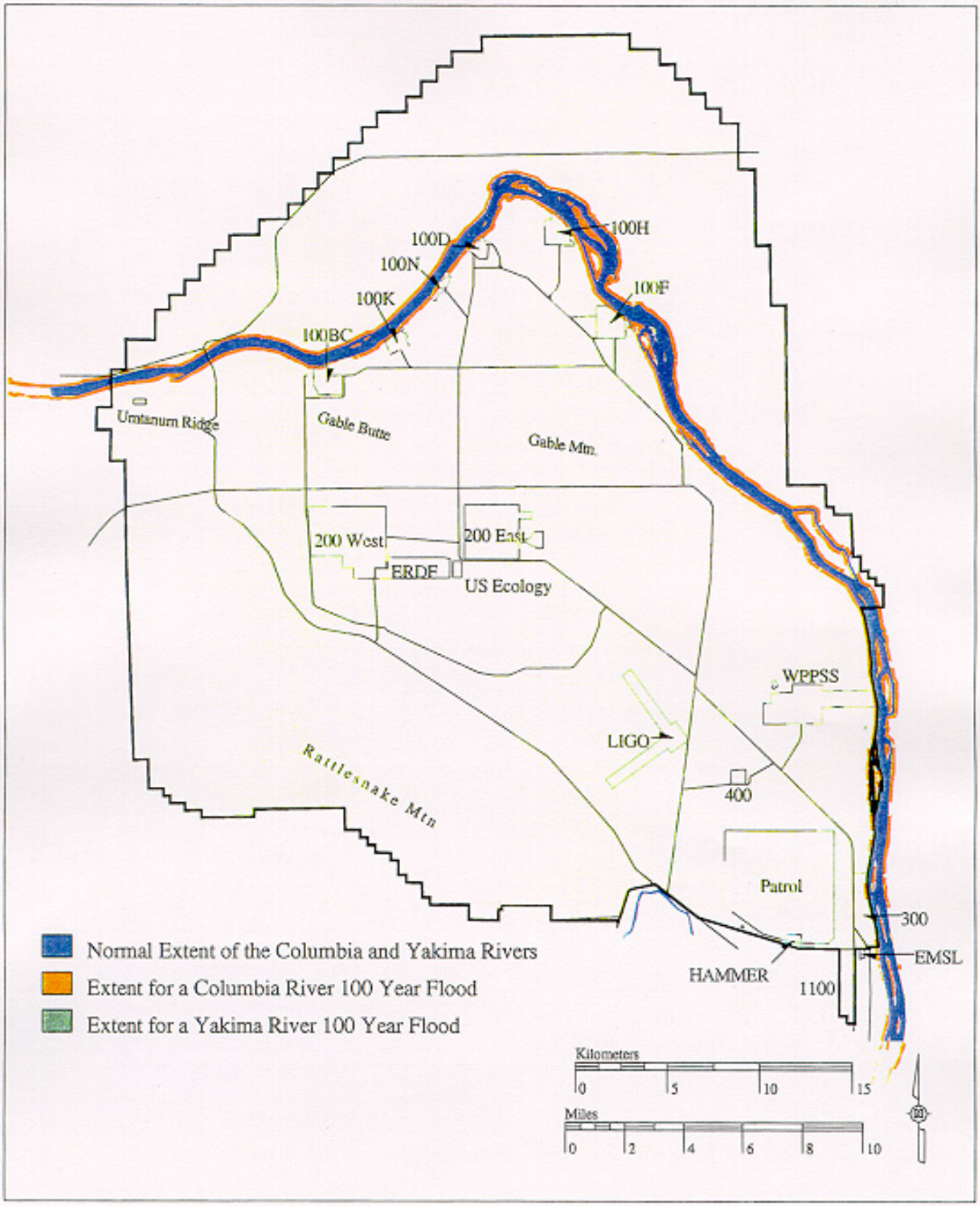
Wetlands on the Hanford Site are associated with the Columbia River, irrigation runoff, and irrigation water wasteways from the Wahluke Slope; and riparian zones associated with spring-fed streams on the ALE Reserve (Figure C-3). Many of the beneficial wetland functions could be adversely affected by activities that might occur under certain land-use designations.

C.2.1 No-Action Alternative

Under the No-Action Alternative, impacts to wetlands and floodplains in the ALE Reserve would be minimal. The area is presently managed in a way similar to a Preservation designation. This management is anticipated to continue into the future. However, in the absence of a formal designation, proposals to develop parcels located in the ALE Reserve could be considered.

The USFWS would manage the Wahluke Slope as the Saddle Mountain National Wildlife Refuge (similar to Preservation) and the Wahluke Wildlife Recreation Area (similar to Conservation). Impacts to wetlands and floodplains in the Wahluke Slope geographic area would be minimal as long as these areas continue to be managed in similar ways.

Figure C-1. 100-Year Floodplain of the Columbia and Yakima Rivers.



Database: 12-NOV-1998
BHI:rpp 04/22/96 clup/flood3.aml

Figure C-2. Extent of the Probable Maximum Flood in the Cold Creek Area.

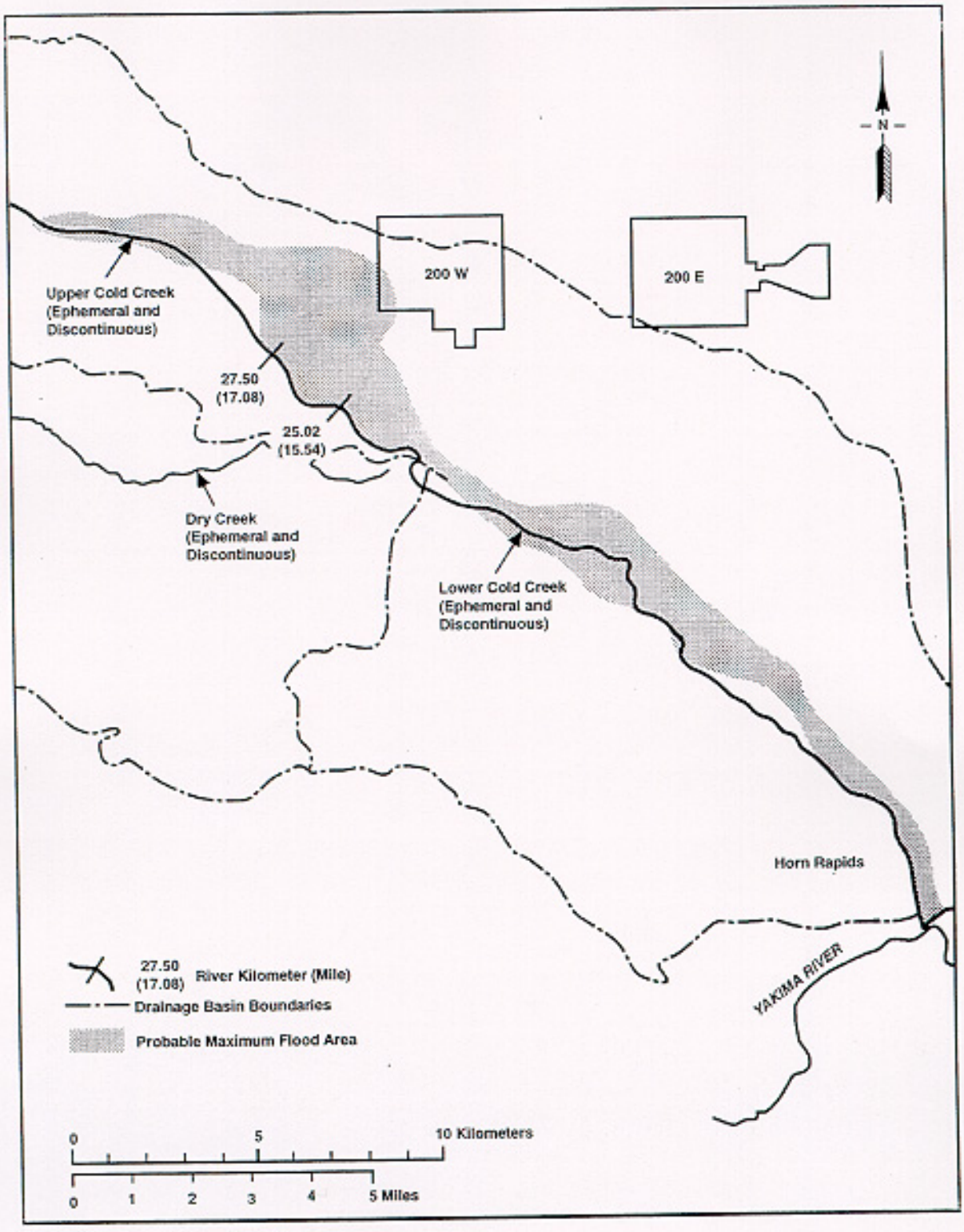
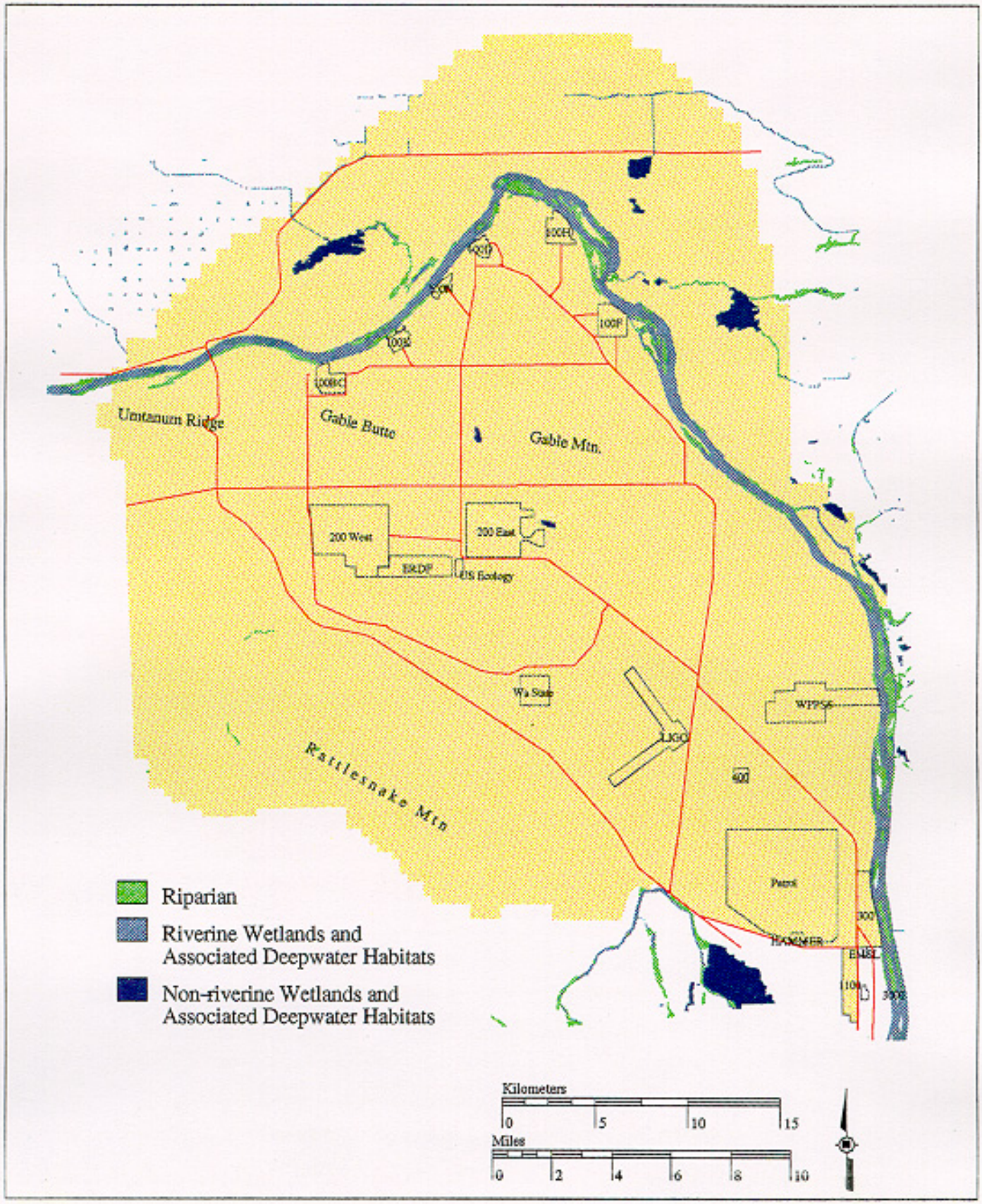


Figure C-3. Wetlands and Deep Water Habitats of the Hanford Site.



The No-Action Alternative would also maintain the status quo for the Columbia River Corridor. The river could be used for recreation, but access to the islands would not be permitted.

The Central Plateau would continue to be used for waste management (Industrial-Exclusive use) under the No-Action Alternative. Although disturbance of wetlands and development of floodplains would be anticipated to be high with this land-use, wetlands and floodplains are essentially absent in this area. The lack of wetlands and floodplains is a primary consideration in designating the area for Industrial-Exclusive land use.

The No-Action Alternative does not include any particular land-use designations for the remainder. All areas could potentially be developed if appropriate uses were identified in the future. Floodplains and wetlands along the Columbia River could be impacted by future development.

C.2.2 Preferred Alternative

Although the Preferred Alternative would designate an area immediately south of State Highway 240 for Conservation (Mining) to allow for possible development of a quarry within the ALE Reserve, no wetlands are located in this area. No impacts to wetlands or floodplains are anticipated to occur under the Preservation designation. The area designated for Conservation (Mining) is adjacent to or located within the Cold Creek probable maximum floodplain, and infrastructure developed to support a quarry site and transport materials would cross the floodplain. This infrastructure could cause some small impacts to floodplain function because the infrastructure could interfere with movement of water under flood conditions.

The Wahluke Slope is designated for Preservation under the Preferred Alternative. The Preservation designation is applied to all wetland and floodplain areas within this area. Impacts to wetlands on the Wahluke Slope would be minimal.

Land-use designations along the Columbia River Corridor would include Preservation, Conservation (Mining), Low-Intensity Recreation, and High-Intensity Recreation. The Preservation designation would be applied to the river islands, and the Conservation (Mining) designation would encompass lands surrounding the surplus reactors, but not near the River. Low-Intensity Recreation designations apply to places with existing boat launches that are not presently available for public use, to the river itself, and to an area along the Columbia River west of the B Reactor. High-Intensity Recreation is associated with the B Reactor, which may be designated as a National Historic Landmark and open to tourists.

Under the High- and Low-Intensity Recreation land-use designations, impacts to floodplains would be minimal. However, increased use of recreational watercraft could lead to damage to wetlands. High-Intensity Recreation would lead to wetland damage due to intensive use of recreational watercraft, potential off-road vehicle traffic, and foot traffic. Wetlands that would be adversely impacted would be those in the vicinity of the areas designated for High-Intensity Recreation, with impacts diminishing with distance from the high use areas.

Increased activity in the river under the Conservation designation would also potentially lead to damage to wetlands associated with the Columbia River riparian zone. Impacts to wetlands and floodplains associated with the Columbia River are influenced by the land-use designations adjacent to the river, with more aggressive use of the land leading to a greater degree of damage.

The Preferred Alternative would designate the Central Plateau for Industrial-Exclusive use. No wetlands or floodplains are present within the Central Plateau and no impacts would be anticipated. The lack of wetlands or floodplains in this geographic area is a primary

consideration in designating the area for Industrial-Exclusive land use.

The Preferred Alternative would designate portions of the remainder of the Hanford Site for Preservation, Conservation (Mining), Industrial use, Low- and High-Intensity Recreation, and Research and Development. Areas within the Cold Creek floodplain would be designated for Conservation (Mining) and Research and Development. Areas within the Yakima River floodplain would be designated for Industrial use and Research and Development. These activities are anticipated to have little impact on the floodplain because development would be minimal and the affected areas are small. Areas along the Columbia River designated for Low- and High-Intensity Recreation could adversely impact wetlands in the vicinity of the land designated for these uses. No wetlands are located within the areas designated for Industrial use.

C.2.3 Alternative One

Alternative One would designate the majority of the Hanford Site as Preservation consistent with the expansion of the Saddle Mountain National Wildlife Refuge. No impacts to wetlands or floodplains are anticipated to occur under the Preservation designation.

Alternative One would designate land along the Columbia River Corridor as Preservation, and for Low- and High-Intensity Recreation. The Preservation designation would apply to small upland areas, the river islands, and land adjacent to the river. Low-Intensity Recreation designations apply to places with existing boat launches that are not presently available for public use, to the river itself, and to an area along the Columbia River west of the B Reactor. High-Intensity Recreation is associated with the B Reactor, which may be designated as a National Historic Landmark and open to tourists.

Under the High- and Low-Intensity Recreation land-use designations, impacts to floodplains would be low. High-Intensity Recreation could lead to wetland damage due to intensive use of recreational watercraft, potential off-road vehicle traffic, and foot traffic. Increased activity in the river under the Conservation designation could potentially lead to damage to wetlands associated with the Columbia River riparian zone. Impacts to wetlands and floodplains associated with the Columbia River are influenced by the land-use designations adjacent to the river, with more aggressive use of the land leading to a greater degree of damage. Alternative One designates all land on both sides of the Columbia River for Preservation, with the exception of a small area designated for High-Intensity Recreation in the vicinity of the B Reactor. Impacts to wetlands and floodplains associated with the Columbia River would be minimal under this alternative.

Alternative One would designate the Central Plateau for Industrial-Exclusive use. No wetlands or floodplains are present within the Central Plateau and no impacts would be anticipated. The lack of wetlands or floodplains in this geographic area is a primary consideration in designating the area for Industrial-Exclusive use.

Alternative One includes an area designated for Industrial use in the South 600 Area. No wetlands or floodplains are included in areas designated for this use pattern. Impacts to floodplains and wetlands under this alternative would be minimal or nonexistent.

C.2.4 Alternative Two

Wetland areas on the ALE Reserve and the Wahluke Slope are designated for Preservation under Alternative Two. Under this designation, no adverse impacts to the wetlands or floodplains would be anticipated. The Preservation designation would provide protection for the wetlands and floodplains from disturbance and development. All lands along the Columbia River would also be designated for Preservation under Alternative Two except for the area

associated with the B Reactor, which is designated for High-Intensity Recreation. Impacts to wetlands and floodplains associated with the river would be minimal.

Alternative Two would designate the Central Plateau for Industrial-Exclusive use. No wetlands or floodplains are present within the Central Plateau and no impacts would be anticipated. The lack of wetlands or floodplains in this geographic area is a primary consideration in designating the area for Industrial-Exclusive land use.

Alternative Two includes an area designated for Industrial use and Preservation within the "All Other Areas" geographic area. No areas within wetlands or floodplains are designated for this use pattern. Impacts to floodplains and wetlands under this alternative would be minimal or nonexistent.

C.2.5 Alternative Three

The ALE Reserve would be designated for Conservation (Mining) areas under Alternative Three, including wetland and floodplain areas. Impacts to wetlands and floodplains that could occur under a Conservation (Mining) designation are anticipated to be similar to impacts under the Preservation designation. Mining activities would probably be similar to quarry operations and would involve a quarry site operation. These operations would be localized and would be anticipated to have minimal impact on floodplains.

Alternative Three designates portions of the Wahluke Slope for Agriculture, Conservation (Mining and Grazing), and High-Intensity Recreation. Wetlands within the Wahluke Slope are located in areas designated for Agriculture or Conservation (Mining and Grazing). Up to 261 ha (645 ac) of wetlands and associated deep water habitats could be directly and adversely impacted by Agriculture. Impacts to the remaining 739 ha (1,825 ac) of wetlands in the Wahluke Slope could also include non-point source runoff of agricultural chemicals, and impacts to wetlands due to runoff are anticipated to be minimal. Wetlands in this area exist as a result of irrigation runoff from agricultural areas surrounding the Wahluke Slope. The Agriculture designation also applies to land within the "Red Zone Area" designated for no irrigation. If irrigated agriculture were ultimately developed in this area, increased slumping of the White Bluffs would be expected to occur. This increased slumping would adversely affect existing wetlands and riparian habitat along the Columbia River, and would cover any floodplain in the area of the slump.

The Columbia River would continue to be used as a recreational river with additional development associated with the High-Intensity Recreation designation. The Low-Intensity Recreation designation under Alternative Three applies to a trail enabling access to the river from State Highway 24 to the north of the river and running along the river. Although portions of this trail would be located within the Columbia River floodplain, impacts to the floodplain would be minimal. A small area adjacent to the Columbia River is designated for High-Intensity Recreation and this designation would be anticipated to have a potential for adverse impacts to the 5 ha (12 ac) of riparian habitat in the area designated for High-Intensity Recreation.

Under the High- and Low-Intensity Recreation designations, impacts to floodplains would be minimal. However, increased use of recreational watercraft could lead to damage to wetlands. High-Intensity Recreation could lead to wetland damage due to intensive use of recreational watercraft, potential off-road vehicle traffic, and foot traffic. Wetlands that could be adversely impacted would be those in the vicinity of the areas designated for High-Intensity Recreation, with impacts diminishing with distance from the high use areas.

Alternative Three would designate the Central Plateau for Industrial-Exclusive use. No wetlands or floodplains are present within the Central Plateau and no impacts would be anticipated. The lack of wetlands or floodplains in this geographic area is a primary

consideration in designating the area for Industrial-Exclusive use.

Alternative Three would designate areas within the remainder of the Hanford Site for Conservation (Mining), Industrial Use, Research and Development, Low-Intensity Recreation, and High-Intensity Recreation. The Cold Creek floodplain overlaps with areas designated for Conservation (Mining), Research and Development, and High-Intensity Recreation; the Yakima River floodplain overlaps an area designated for High-Intensity Recreation. These land-use designations, especially High-Intensity Recreation, could adversely impact these floodplains.

C.2.6 Alternative Four

Wetland areas on the ALE Reserve would be designated for Preservation. No impacts to wetlands or floodplains are anticipated to occur under the Preservation designation. An area immediately south of State Highway 240 would be designated for Conservation (Mining) to allow for possible development of a quarry. The area designated for Conservation (Mining) under Alternative Four is adjacent to or located within the Cold Creek probable maximum floodplain, and infrastructure developed to support a quarry site and transport materials would cross the floodplain. This infrastructure could cause some small impacts to floodplain function because the infrastructure could interfere with movement of water under flood conditions. Potential impacts to wetlands and floodplains in the ALE Reserve would be similar to impacts under the Preservation designation. Mining activities would probably be similar to quarry operations and would involve a quarry-site operation that would have minimal impact on the Cold Creek floodplain.

Alternative Four would designate the Wahluke Slope and all lands on both sides of the Columbia River for Preservation, and for High- and Low-Intensity Recreation. Impacts to wetlands and floodplains in the Columbia River Corridor geographic area would be minimal, and no adverse impacts to the wetlands or Columbia River floodplain on the Wahluke Slope geographic area would be anticipated. The Preservation designation would provide protection for the wetlands and floodplains from disturbance and development.

Alternative Four would designate the Central Plateau for Industrial-Exclusive use. No wetlands or floodplains are present within the Central Plateau and no impacts would be anticipated. The lack of wetlands of floodplains in this geographic area is a primary consideration in designating the area for Industrial-Exclusive use.

Alternative Four would designate the majority of the land in the remainder of the Hanford Site for Preservation and for Conservation. Areas would also be designated for Research and Development and for Industrial use. All areas within the boundaries of wetlands and floodplains would be designated for Preservation or Conservation, and impacts to these areas would be negligible.

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